


FORM PTO-1390 (REV 11-2000)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 677-22
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5) 09/806907 Unknown
INTERNATIONAL APPLICATION NO. PCT/FR99/02470	INTERNATIONAL FILING DATE 13 October 1999	PRIORITY DATE CLAIMED 13 October 1998
TITLE OF INVENTION METHOD FOR EXCHANGING DATA BETWEEN AN AUTOMATIC DISPENSER AND A MICROCIRCUIT CARD		
APPLICANT(S) FOR DO/EO/US GRIEU et al.		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below. 4. <input checked="" type="checkbox"/> The U.S. has been elected by the expiration of 19 months from the priority date (Article 31). 5. A copy of the International Application as filed (35 U.S.C. 371(c)(2)). <ol style="list-style-type: none"> a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau). b. <input checked="" type="checkbox"/> has been communicated by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)) and a Declaration of Translation. <ol style="list-style-type: none"> a. <input checked="" type="checkbox"/> is attached hereto. b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau). b. <input type="checkbox"/> have been communicated by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). 		
Items 11 To 20 below concern document(s) or information included:		
<ol style="list-style-type: none"> 11. <input type="checkbox"/> An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98. 12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. 14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 15. <input type="checkbox"/> A substitute specification. 16. <input type="checkbox"/> A change of power of attorney and/or address letter. 17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821-1.825. 18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4). 19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4). 20. <input checked="" type="checkbox"/> Other items or information. PTO-1449/ International Search Report 		

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) Unknown 097806907		INTERNATIONAL APPLICATION NO. PCT/FR99/02470		ATTORNEY'S DOCKET NUMBER 677-22	
21. <input checked="" type="checkbox"/> The following fees are submitted:				CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5)): -- Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO\$1000.00 -- International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO\$860.00 -- International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO\$710.00 -- International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4)\$690.00 -- International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)\$100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$	860.00
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).				\$	0.00
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	16	-20 =	0	X	\$18.00
Independent Claims	1	-3 =	0	X	\$80.00
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)					\$270.00
TOTAL OF ABOVE CALCULATIONS =				\$	860.00
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.					0.00
SUBTOTAL =				\$	860.00
Processing fee of \$130.00, for furnishing the English Translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f)).					0.00
TOTAL NATIONAL FEE =				\$	860.00
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). \$40.00 per property					40.00
Fee for Petition to Revive Unintentionally Abandoned Application (\$1240.00 - Small Entity = \$620.00)					0.00
TOTAL FEES ENCLOSED =				\$	900.00
				Amount to be:	
				refunded	\$
				Charged	\$
a. <input checked="" type="checkbox"/> A check in the amount of \$900.00 to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. 14-1140 in the amount of \$_____ to cover the above fees. A duplicate copy of this form is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-1140. A duplicate copy of this form is enclosed. d. <input checked="" type="checkbox"/> The entire content of the foreign application(s), referred to in this application is/are hereby incorporated by reference in this application.					
NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: NIXON & VANDERHYTE P.C. 1100 North Glebe Road, 8 th Floor Arlington, Virginia 22201-4714 Telephone: (703) 816-4000					
				 SIGNATURE	
				Stanley C. Spooner NAME	
				27,393 REGISTRATION NUMBER	
				April 6, 2001 Date	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

GRIEU et al.

Atty. Ref.: 677-22

Serial No. Unknown

Group:

Filed: April 6, 2001

Examiner:

For: METHOD FOR EXCHANGING DATA BETWEEN AN AUTOMATIC DISPENSER
AND A MICROCIRCUIT CARD

* * * * *

April 6, 2001

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

PRELIMINARY AMENDMENT

In order to place the above-identified application in better condition for examination,
please amend the application as follows:

IN THE CLAIMS

Please substitute the following amended claims for corresponding claims previously
presented. A copy of the amended claims showing current revisions is attached.

3/ (Amended) The method of claim 1, in which conditional debiting of the card is also
subordinate to a time delay elapsing since the preceding operation of putting the flag into the
non-ratified state.

4/ (Amended) The method of claim 1, in which conditional debiting of the card is also
subordinate to the machine performing the current transaction belonging to a group to which the
machine that performed the preceding transaction also belongs.

5/ (Amended) The method of claim 1, in which, when the flag is in the non-ratified state, delivery without debit is inhibited if the machine detects that delivery took place during the preceding use of the card.

6/ (Amended) The method of claim 1, in which card debiting and putting the flag into the non-ratified state are performed in indivisible manner.

7/ (Amended) The method of claim 1, in which at least a portion of the information modifying the state of the card, in particular commands enabling the flag to be put into the ratified state, is previously processed by cryptographic means implemented both in the card and in the machine.

8/ (Amended) The method according to claim 1, in which at least a portion of the information relating to the state of the card, in particular the state of the flag and confirmation that the debit has taken into account, is previously processed by cryptographic means implemented both in the card and in the machine.

9/ (Amended) The method of claim 1, in which the goods or service is delivered in deferred manner after a given time delay.

12/ (Amended) The method of claim 1, in which the information interchanged between the machine and the card is enciphered in such a manner as to avoid revealing the moment at which the machine instructs the card to put the flag into the ratified state, or the moment at which the card performs that instruction.

13/ (Amended) The method of claim 1, including, in the machine, counting the number of occasions on which it reads a flag in the non-ratified state.

14/ (Amended) The method of claim 1, including the card counting the number of occasions on which it stores the flag in the non-ratified state between two transactions.

15/ (Amended) The method of claim 13, in which means are provided to indicate that a given threshold has been exceeded by the count in the card, in particular means for inhibiting subsequent delivery of goods or service.

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16/ (Amended) The method of claim 1, in which the card memory includes information about the kind of goods or service to be delivered, which information is updated before any delivery of said goods or service.

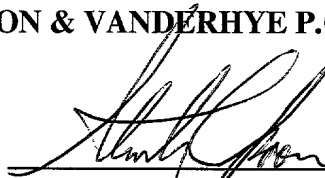
REMARKS

The above amendments are made to place the claims in a more traditional format. Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version With Markings To Show Changes Made.**"

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

3/ (Amended) The method of [either preceding claim] claim 1, in which conditional debiting of the card is also subordinate to a time delay elapsing since the preceding operation of putting the flag into the non-ratified state.

4/ (Amended) The method of [any preceding claim] claim 1, in which conditional debiting of the card is also subordinate to the machine performing the current transaction belonging to a group to which the machine that performed the preceding transaction also belongs.

5/ (Amended) The method of [any preceding claim] claim 1, in which, when the flag is in the non-ratified state, delivery without debit is inhibited if the machine detects that delivery took place during the preceding use of the card.

6/ (Amended) The method of [any preceding claim] claim 1, in which card debiting and putting the flag into the non-ratified state are performed in indivisible manner.

7/ (Amended) The method of [any preceding claim] claim 1, in which at least a portion of the information modifying the state of the card, in particular commands enabling the flag to be put into the ratified state, is previously processed by cryptographic means implemented both in the card and in the machine.

8/ (Amended) The method according to [any preceding claim] claim 1, in which at least a portion of the information relating to the state of the card, in particular the state of the flag and confirmation that the debit has taken into account, is previously processed by cryptographic means implemented both in the card and in the machine.

9/ (Amended) The method of [any preceding claim] claim 1, in which the goods or service is delivered in deferred manner after a given time delay.

12/ (Amended) The method of [any preceding claim] claim 1, in which the information interchanged between the machine and the card is enciphered in such a manner as to avoid

revealing the moment at which the machine instructs the card to put the flag into the ratified state, or the moment at which the card performs that instruction.

13/ (Amended) The method of [any preceding claim] claim 1, including, in the machine, counting the number of occasions on which it reads a flag in the non-ratified state.

14/ (Amended) The method of [any preceding claim] claim 1, including the card counting the number of occasions on which it stores the flag in the non-ratified state between two transactions.

15/ (Amended) The method of claim 13 [or 14], in which means are provided to indicate that a given threshold has been exceeded by the count in the card, in particular means for inhibiting subsequent delivery of goods or service.

16/ (Amended) The method of [any preceding claim] claim 1, in which the card memory includes information about the kind of goods or service to be delivered, which information is updated before any delivery of said goods or service.

A METHOD OF INTERCHANGING DATA BETWEEN AN AUTOMATIC
MACHINE AND A PORTABLE OBJECT, IN PARTICULAR A
MICROCIRCUIT CARD, THE OBJECT BEING SUITABLE FOR DEBITING
BY THE MACHINE IN CONSIDERATION FOR PROVIDING GOODS OR
5 SERVICE

The present invention relates to automatic
transaction systems that deliver goods or service by
means of a machine exchanging information with a portable
object which is debited by a given amount or value in
10 consideration for the delivery of goods or service.

The machine can be an automatic dispenser, e.g. for
dispensing confectionery or drinks, or it can be a device
for providing a service, for example controlled access
implemented by opening a turnstile so as to give a
15 traveller access to a transport system. Below, the term
"delivery of goods" is sometimes used for short, but it
should be understood that the invention naturally covers
a much wider range of applications, including the
delivery of all sorts of services.

In the same manner, although the portable object
considered by way of example is a microcircuit card, the
invention can also be applied to other types of portable
object, such as magnetic cards or travel tickets, e.g. in
the form of a magnetic coupon or the like. Nevertheless,
25 it is preferred to use a microcircuit card, given the
very high degree of security and reliability that is made
possible thereby.

Goods or service is delivered as the result of
implementing a transaction during which the card is
30 temporarily coupled to the machine to enable information
to be exchanged between the card and the machine, with
payment being performed at least in part by modifying
information stored in the memory of the card, which
information is representative of the value contained in
35 the card.

Coupling can be achieved between the card and the
machine in various known ways, with or without metallic

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contact, and it is shown that the invention applies most advantageously to coupling of the so-called "contactless" type. With that type of coupling, there exists a non-negligible risk of communication between the card and the machine being interrupted in unexpected manner, e.g. because the card has moved out of the range of the machine before processing had been completed, or because of some temporary disturbance, e.g. the passage of a mass of metal close by, or indeed because the user passes the card too quickly in front of the machine to enable information to be interchanged in satisfactory manner.

The event that interrupts a transaction can equally well be accidental or deliberate, for example the user might deliberately seek to obtain delivery while nevertheless preventing the corresponding amount from being debited from the card.

In the context of an automatic transaction system of the kind described above, one of the objects of the invention is to associate payment (i.e. debiting of the card) with delivery in such a manner as to preserve not only the interests of the purchaser (user) but also those of the vendor (the operator of the machine), even if an event should interrupt the transaction or prevent payment being achieved.

Until now, the problem has usually been dealt with in one of the following ways:

- no action is taken technically, so the event has to be dealt with by some human procedure;

- the card is temporarily prevented from being withdrawn by the user, and the machine debits the card if and only if the goods or service is indeed delivered (this applies for example to machines in which the card is hidden by a flap or is "swallowed" while the transaction is taking place); and

- the card remains accessible to the purchaser: this avoids the need to provide an expensive mechanism which slows down the transaction and is in any event

inapplicable to transactions that take place without contact. However special precautions then need to be taken.

5 The third situation, in which the card remains physically accessible to the user leads to one or other of the following situations:

· debiting takes place after delivery: the purchaser can attempt to prevent debiting, e.g. by withdrawing the card immediately after delivery or by making debiting
10 impossible in some other way (e.g. by insulating one of the contact areas of the card's microcircuit by means of a piece of adhesive); this can be acceptable if delivery is intrinsically spread out in time, for example a telephone call, in which case the advantage gained by
15 such fraud is highly limited; however it is unsatisfactory if the machine delivers an article or opens a turnstile; and

· debit takes place prior to delivery: under such circumstances, there is a risk of the purchaser being
20 out-of-pocket because payment has taken place by information being interchanged over a communications channel that can be interrupted by the card being extracted or moving too far away; in other words it is possible that the card is debited but that the machine
25 does not deliver goods or service since the debit is not confirmed.

The invention lies in the general context corresponding to the last-mentioned situation above, i.e. the situation in which the card is debited prior to
30 delivery.

In the most general terms, a transaction takes place as follows:

- 10) the machine causes the card to be debited;
- 20) the card modifies its monetary value information
35 (or some equivalent value in terms of "tokens");

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30) the card confirms to the machine that debiting has indeed taken place, i.e. that the monetary value in its memory has indeed been modified; and

40) the machine delivers the goods or service.

5 As will readily be understood, if the interchange between the card and the machine happens to be interrupted during step 30, then the purchaser will be out-of-pocket.

10 To mitigate that drawback, various practices have been used in the past:

15 · if the purchaser withdraws the card in the middle of a transaction, it is the purchaser who is considered as being at fault and it is the purchaser who is liable to be penalized; in the event of the purchaser making a complaint, more-or-less arbitrary procedures are provided for indemnifying the user or for establishing means for determining after the event whether the transaction recorded in the card was indeed followed by delivery by the machine;

20 · the purchaser is debited in small amounts only while delivery is taking place, so if the purchaser is indeed out-of-pocket, then the amount involved will be small and can be accepted: that solution is entirely suitable for delivering fluids or telephone calls, but it is impractical for delivering articles or for giving access to a transport network; and

25 · a system is provided such that if the current transaction is interrupted with prejudice to the purchaser, then in a subsequent "resumption" transaction, the goods or service can indeed be delivered, but without any further payment, i.e. without debiting the card again.

30 This third solution is a known practice as used for example in electronic purses complying with the draft European standard EN 1546.

35 In such known circumstances, if payment has taken place, and if the user who has not obtained delivery

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restarts the transaction on the same machine, and if the new transaction (resumed transaction) is carried through successfully, then goods or service will indeed be delivered for fair payment.

5 Known systems for implementing a resumption transaction nevertheless share the following drawback.

If communication between the machine and the card is interrupted during above step 30, and if the user does not re-establish the link between the card and the same machine, then the user will be out-of-pocket.

10 In particular, when a plurality of machines exist close together for delivering identical goods or service (for example a row of turnstiles giving access to a transport network), a client who has passed a contactless card rather too fast and who finds that the turnstile has not opened, will often try again at an adjacent turnstile, i.e. using a machine other than the machine on which the initial transaction was begun. The second machine will debit the client even if the first machine has already made the same debit, such that the purchaser will be debited twice for single delivery of the same goods or service (one opening of the turnstile).

20 It is possible to mitigate that drawback by interconnecting machines in the same zone by means of a network enabling information suitable for resuming a transaction to be interchanged, e.g. a card identity number, the number of the last machine to have ordered a debit, the corresponding transaction number for that machine, etc. thus making it possible for the transaction to be resumed on any of the machines in the network.

30 The use of such a network suffers from two drawbacks, in particular:

- the need for a network, with its associated hardware and software constraints; and

- 35 • the fact that each machine must interrogate the network on every occasion prior to instructing the debiting of a card (step 10 above), thereby slowing down

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the transaction, or else each machine must store locally all of the information relating to transactions that have not terminated and that have taken place (at least recently) on the other machines in the network, and it must be capable of searching quickly to determine whether the card it is about to debit coincides with one such non-terminated transaction.

The invention proposes a solution to the above problem which avoids or minimizes the need to use a network, and which has characteristics that enable it to satisfy very severe constraints, such as those associated with a contactless card in transport situations, where each transaction:

- must take place quickly (about 0.1 seconds);
- can easily be interrupted without the user being at fault (card handled too fast or not accurately enough);
- can implement a plurality of payment points (a plurality of turnstiles) between which the purchaser can move quickly (e.g. 1 or 2 seconds to go from one turnstile to the next); and
- must be capable of operating satisfactory in the event of a breakdown of any one of its elements, in particular the network interconnecting the machines, supposing that such a network is implemented.

To this end, the invention provides a method of interchanging data between the non-volatile memory of a portable object, in particular a microcircuit card, and an automatic machine with which the card is temporarily coupled to enable goods or service to be delivered, the card having value information that can be debited by the machine in consideration for delivering the goods or service, the method being characterized in that it comprises steps in which the machine causes a ratification flag to be modified, which flag is stored in the non-volatile memory of the card, said flag having two states, a ratified state corresponding to the case in

which the preceding transaction performed with the card, whether by the same machine or another machine, took place correctly, and a non-ratified state for the case in which said preceding transaction was interrupted while it was being executed, and in which the machine successively: conditionally debits the card if the flag is in the ratified state; causes the card to put the flag into the non-ratified state if a debit took place during the preceding step; then causes the goods or service to be delivered; and if delivery takes place effectively in the preceding step, causes the card to put the flag into the ratified state.

The method may include the following steps in particular: a) the machine reads the state of the ratification flag and jumps to step e) if it is in the non-ratified state; b) the machine causes the card to be debited by an amount corresponding to the goods or service to be delivered; c) the card records the debit by updating its value information, and it puts the flag into the non-ratified state; d) the card confirms to the machine that the debit has been recorded; e) the machine delivers the goods or service; f) the machine causes the flag to be set to the ratified state; and g) the card changes the state of the flag to put it into the ratified state.

According to various advantageous subsidiary characteristics:

- conditional debiting of the card is also subordinate to a time delay elapsing since the preceding operation of putting the flag into the non-ratified state and/or to the machine performing the current transaction belonging to a group to which the machine that performed the preceding transaction also belongs;

- when the flag is in the non-ratified state, delivery without debit is inhibited if the machine detects that delivery took place during the preceding use of the card;

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· the card memory includes information about the kind of goods or service to be delivered, which
35 information is updated before any delivery of said goods or service.

Other characteristics and advantages appear from the following description of an example implementation of the invention.

5 **Example**

The description beings by explaining how a prior art system with a resumption transaction is constituted (this system is close in particular to the draft standard EN 1546 for the electronic purse, but it is transposable
10 to a large number of other applications).

In its memory, each card possesses:

a) a card identity number which is invariable and characteristic of the card;

b) the number of the last automatic machine to have
15 caused a debit operation to be performed in the card;

c) the number of that transaction for that machine; and

d) the value of the card, i.e. the monetary amount or its equivalent in tokens, which is the data item on
20 which debiting is performed.

Each machine possesses in its own memory:

A) the number of the last card in which it preformed a debit operation;

B) a machine identity number that is invariable and
25 characteristic; and

C) a transaction number which is incremented by the machine on each transaction.

A transaction essentially comprises the following steps:

30 05) the machine reads data items a, b, and c from the card and determines whether $a = A$, $b = B$, and $c = C$; in the affirmative, it goes directly to step 40;

 10) the machine causes the amount D corresponding to the goods that are to be delivered to be debited from the
35 card, and also causes the following to be written in the card: $a = A$, $b = B$, and $c = C$;

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20) the card records the debit, i.e. it replaces d by (d-D) and a, b, and c by the values communicated to it, i.e. A, B, and C;

30) the card confirms to the machine that the debit
5 has been recorded; and

40) the machine delivers the goods and replaces C by C+1.

Naturally, the transaction includes steps associated with establishing, running, and terminating communication
10 between the machine and the card, steps for booking the sums collected by the machine, and steps for generating and verifying the cryptographic certificates required for ensuring that the values interchanged are authentic. These steps which are themselves known are not involved
15 in implementing the invention (unless otherwise stated) and are not described in greater detail.

Steps are also provided for handling the case where the value in the card is insufficient, with processing adapted to stop operation: for example, the value of the
20 card is read initially by the machine, is compared with the amount of the transaction, and step 10 is inhibited if there is not sufficient credit; in a variant or in addition, it is also possible to provide for the card to perform the same check and to inhibit steps 20 and 30.

25 The various operations performed in step 20 are advantageously performed in indivisible manner, i.e. provision is made in the card for means such that if step 20 is interrupted, then any subsequent read will find data items a, b, c, and d either all unchanged, or else
30 all changed under the control of the machine, but under no circumstances will only some of them have been modified.

As mentioned above, in the event of communication
35 between the machine and the card being interrupted during step 40, if the user tries again on a machine that is not the same machine as the machine on which the initial transaction was interrupted, then the second machine will

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debit the card even if the card has already been debited by the first machine. The purchaser will thus be debited twice for a single item, and will therefore be out-of-pocket because of the resumed transaction.

5 To mitigate that difficulty, and to provide an acceptable compromise between ensuring that the purchaser is not out-of-pocket and protecting against fraud, the invention essentially provides for a bit \mathfrak{R} in the memory of the card, which bit is referred to as a "ratification bit" and can take the following two states (it being
10 understood that the functions performed by the values 0 and 1 could be interchanged):

State 0 ("ratified"): this is the normal case, the user's previous transaction took place properly, so the
15 machine will subsequently deliver the goods and debit the card;

State 1 ("not ratified"): the preceding transaction did not terminate correctly (the goods were not delivered), so the goods should be delivered subsequently
20 without debiting the card.

If it is appropriate to debit the card, the flag is put into state 1 by the machine prior to delivering the goods, and if the goods are subsequently delivered, then the machine causes \mathfrak{R} to be put into state 0. More
25 precisely, the transaction comprises the following steps:

05) the machine reads the state of \mathfrak{R} in the card; if it is in state 1, then the machine goes directly to step
40;

10) the machine causes the amount D corresponding to
30 the goods to be delivered to be debited from the card;

20) the card records the debit, i.e. it replaces the balance \underline{d} by $(d-D)$ and it puts \mathfrak{R} into state 1;

30) the card confirms to the machine that the debit has been recorded;

35 40) the machine, on receiving the confirmation in step 30, or via the test in step 05, delivers the goods;

45) the machine causes \mathfrak{R} to be put into state 0; and

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50) the card modifies the state of \mathfrak{R} , which goes to state 0.

As can be seen, the debit operation is performed in steps 10, 20, and 30.

5 In the particular case where units are debited, $D = 1$, and that can then be implicit; another special case is that of single use, corresponding to $d = 1$ and then $d = 0$, d being suitable for being reduced by one bit only.

10 It will be observed that the purchaser is never out-of-pocket in the event of making an attempt to perform the same transaction on another machine when the goods have not been delivered by the first (a fortiori if the attempt is made on the same machine), and this takes place in characteristic manner without any need to set up
15 a network between the machines.

Various improvements of the above-described method are described below.

Some of the improvements relate specifically to reducing the probability of a situation in which steps 05
20 to 45 take place normally, but the transaction is interrupted immediately after step 45, which prevents step 50 from being performed.

Under such circumstances, the purchaser to whom the machine has delivered the goods (step 40) is in a
25 position to receive the goods again in a new transaction without being debited a second time. It is therefore in the interest of the user to prevent step 50 being performed, e.g. by deliberating passing the card quickly past the machine so as to be able to interrupt the
30 transaction immediately after step 45 has been executed.

A *first improvement* consists in step 05 in going to step 40 (second alternative branch after testing the state of \mathfrak{R}) only if conditions are satisfied other than merely \mathfrak{R} equals 1, and in particular conditions based on
35 the time that has elapsed since \mathfrak{R} was set to 1 and/or the identity of the machine that had previously set the flag.

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For this purpose, information is associated in the card with the flag, this information being characteristic of the time and/or the nature of the machine which performed the previous debit (and/or caused the flag to be set) in a preceding transaction. This information is advantageously written during step 20 (in the same manner as in step 20 of a prior art transaction, as described above).

The information stored in the card is compared with corresponding information characteristic of the current time and/or of the nature of the machine which is getting ready to deliver the goods.

By way of example, in an application to transport, the effect of this improvement is to enable a transaction to be resumed with the purchaser receiving undue advantage only if the preceding operation began to take place on the same set of payment locations and a length of time ago that is short enough to exclude re-use for a new trip. With this precaution, a traveller cannot make two trips for the price of one, and the possible opening of a turnstile for a second traveller (representing the non-ratified ticket of the first traveller) does not harm the transport supplier any more than does forced passage through a turnstile, insofar as in any event one of the travellers will be found to have not paid if ever there is an inspection.

A *second improvement* consists in step 05 in inhibiting passage to step 40 (second alternative branch after testing the state of \mathcal{R}) if the machine has previously performed a transaction on the same card that was completed all the way to proper execution of delivery. This improvement has the effect of requiring the purchaser in any event to change machine before having any hope of obtaining double delivery.

The machine performs this detection, for example by consulting a history of the transactions that it has carried out, including for each transaction a card

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identifier and an indication as to whether or not delivery took place; the history can be shared between a set of machines if they are interconnected by a communications network (note: in an application to paying for transport, a failure in this network gives rise only to a slight increase in the probability of a ticket being usable via a second turnstile).

Inhibition of free payment can give rise either to the transaction being stopped (as happens in transport in the event of a second use within the time limit specified in the above first improvement), or else by a second delivery but in return for further payment (for example when an article of goods is delivered).

A *third improvement* consists, in step 20, in making the debit and in modifying the flag \mathfrak{R} (and where appropriate writing the information associated with the above-described first improvement) in such a manner that these operations are indivisible.

In other words, means are provided in the card which ensure that if step 20 is interrupted, then any subsequent read will obtain \mathfrak{R} and \underline{d} information (and where appropriate any information associated with the first improvement) that is either completely unchanged, or else completely changed, in compliance with the commands of the machine.

This avoids certain possible kinds of error in favor of the purchaser or of the machine depending on which operations take place without the other.

By way of example (suitable for minimizing the number of writes in memory), the card can have two memory zones Z_0 and Z_1 each containing \mathfrak{R}_i , the balance d_i , a number n_i that can take the value 0 or 1, and a check sum s_i relating to d_i and n_i (s_i is normally the number of 0 bits in d_i and n_i).

Prior to a read (in particular in step 05), the card determines which of the zones Z_0 or Z_1 is valid, and for this purpose it checks the validity of s_i relative to d_i

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and n_i in each of the two zones. If s_i is invalid, then the card ignores or deletes the entire zone; if at the end of this operation only one of the two zones is not ignored or deleted, then this zone is considered as being
 5 valid; if both zones are not ignored or deleted, then the valid zone is given by the following table:

n_0	n_1	valid zone
0	0	Z_1
1	0	Z_0
1	1	Z_1
0	1	Z_0

The values returned by the card for \mathfrak{R} (in step 10) and \underline{d} (taken into account for calculating the new balance in step 20) are \mathfrak{R}_i and d_i in the valid zone.

10 Writing (steps 20 and 50) will take place in the other zone (after it has previously been deleted), using a value of n_i such that the zone in which writing takes place becomes the valid zone, i.e. in accordance with the following table:

if zone valid	and	write in	and
Z_1	$n_1 = 0$	Z_0	$n_0 = 1$
Z_0	$n_0 = 1$	Z_1	$n_1 = 1$
Z_1	$n_1 = 1$	Z_0	$n_0 = 0$
Z_0	$n_0 = 0$	Z_1	$n_1 = 0$

15 Writing takes place in this zone during step 20 with $\mathfrak{R}_i = 1$, before or simultaneously with writing of n_i , d_i , and s_i ; at the end of this writing, the zone which is valid has changed.

Step 50 writes $\mathfrak{R}_i = 0$ in the valid zone.

20 Indivisible writing of other information can be treated by extending zones Z_i and data taken into account by the check sums s_i .

A *fourth improvement* consists in subjecting the information that modifies the state of the card, in
 25 particular the commands that enable the ratification flag to be set to state 1, to prior verification by means of a

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device integrated in the card, concerning the validity of a cryptographic certificate integrated in the message and produced in the machine by corresponding means.

5 A *fifth improvement* consists, symmetrically to the preceding improvement, in subjecting information relating to the state of the card, in particular the state of the ratification flag and/or confirmation that the debit has been taken into account to prior verification by a device integrated in the machine, concerning the validity of a
10 message integrity cryptographic certificate as produced in the card by corresponding means.

By way of example, the cryptographic certificate of the fourth and fifth improvements described above can be an electronic message signature as obtained and verified
15 using the method of international standard ISO 9726-2, or more simply using a symmetrical DES type algorithm.

Various other improvements seek to make it more difficult for a user deliberately to interrupt a transaction.

20 A *sixth improvement* thus consists in modifying step 40 by replacing pure and simple delivery of the goods by taking a decision as to whether or not to deliver the goods after a time delay has elapsed. To improve the speed of the system, the goods can be delivered before
25 the time delay has expired if the machine receives confirmation that step 50 has been performed properly, rather than waiting for the time delay to expire. These precautions serve to prevent possible attempts by the purchaser at preventing step 50 by interrupting
30 communication immediately after delivery. The sequence is modified as follows (given that steps 40 and 45 can be interchanged):

- 40) the machine starts a time delay;
- 45) step unchanged;
- 35 50) step unchanged;

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55) the card acknowledges execution of step 50 by issuing a special message (optional step suitable for shortening the average duration of a transaction); and

60) the machine delivers the goods when the time delay expires, or where appropriate, on receiving the message of step 55, at the end of the first of the two terms to elapse. The user is thus deprived of a time marker that might make it possible to interrupt the transaction to the user's advantage.

A *seventh improvement* consists in providing protection against eavesdropping communications between the machine and the card by means such as cryptographic enciphering, so that such eavesdropping cannot reveal the instant at which the command is given to reset the ratification bit \mathfrak{R} to 0 or the instant at which it is indeed reset. This makes it more difficult to determine the instant at which it would be advantageous to interrupt communication.

An *eighth improvement* consists, in addition to the sixth and/or seventh improvements described above, in inserting a randomly-varying pause in the transaction, still for the purpose of making it difficult to determine the instant at which it would be advantageous to interrupt communication. This randomly-varying pause is preferably inserted in a step situated prior to the card being debited.

A *ninth improvement* consists in detecting a situation that is very likely to be abnormal, as revealed by too large a number of free transactions. To this end, an appropriate counter device counts cases in which a decision is made in step 05 to perform delivery without payment. It is also possible to sum the amounts that have thus possibly been lost by the machines. If the counter is integrated in the machine, it can be used for statistical purposes; if it is integrated in the card, it is advantageous to make delivery of the goods or service subordinate to confirmation that the counter has indeed

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been updated in the event of the purchaser not being debited, so that the purchaser at least cannot escape from the counter being updated.

It is possible to provide a device that inhibits
5 delivery of the goods when the counter exceeds a
threshold, or indeed that issues an alarm or some
analogous signal. It is also possible to provide for the
counter to be reset to zero or to be reduced in part
only, e.g. on each transaction that is indeed debited, or
10 to do so with a special device.

A *tenth improvement* consists in recording the kind
of goods to be delivered, e.g. during step 20, and in
reading and using said information specifically when, at
the end of step 05, a decision is taken to make a
15 delivery without debiting it. This makes it possible to
process resumption of the transaction using machines that
are capable of delivering different types of goods or
goods for different amounts, e.g. in a transport system
having different destinations as a function of a
20 selection made by the user.

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CLAIMS

1/ A method of interchanging data between the non-volatile memory of a portable object, in particular a microcircuit card, and an automatic machine with which the card is temporarily coupled to enable goods or service to be delivered, the card having value information that can be debited by the machine in consideration for delivering the goods or service, the method being characterized in that it comprises steps in which the machine causes a ratification flag to be modified, which flag is stored in the non-volatile memory of the card, said flag having two states, a ratified state corresponding to the case in which the preceding transaction performed with the card, whether by the same machine or another machine, took place correctly, and a non-ratified state for the case in which said preceding transaction was interrupted while it was being executed, and in which the machine successively:

- conditionally debits the card if the flag is in the ratified state;
- causes the card to put the flag into the non-ratified state if a debit took place during the preceding step;
- then causes the goods or service to be delivered;
- and
- if delivery takes place effectively in the preceding step, causes the card to put the flag into the ratified state.

2/ The method of claim 1, comprising the following steps:

a) the machine reads the state of the ratification flag and jumps to step e) if it is in the non-ratified state;

b) the machine causes the card to be debited by an amount corresponding to the goods or service to be delivered;

c) the card records the debit by updating its value information, and it puts the flag into the non-ratified state;

5 d) the card confirms to the machine that the debit has been recorded;

e) the machine delivers the goods or service;

f) the machine causes the flag to be set to the ratified state; and

10 g) the card changes the state of the flag to put it into the ratified state.

15 3/ The method of either preceding claim, in which conditional debiting of the card is also subordinate to a time delay elapsing since the preceding operation of putting the flag into the non-ratified state.

20 4/ The method of any preceding claim, in which conditional debiting of the card is also subordinate to the machine performing the current transaction belonging to a group to which the machine that performed the preceding transaction also belongs.

25 5/ The method of any preceding claim, in which, when the flag is in the non-ratified state, delivery without debit is inhibited if the machine detects that delivery took place during the preceding use of the card.

30 6/ The method of any preceding claim, in which card debiting and putting the flag into the non-ratified state are performed in indivisible manner.

35 7/ The method of any preceding claim, in which at least a portion of the information modifying the state of the card, in particular commands enabling the flag to be put into the ratified state, is previously processed by cryptographic means implemented both in the card and in the machine.

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8/ The method according to any preceding claim, in which at least a portion of the information relating to the state of the card, in particular the state of the flag and confirmation that the debit has taken into account, is previously processed by cryptographic means implemented both in the card and in the machine.

9/ The method of any preceding claim, in which the goods or service is delivered in deferred manner after a given time delay.

10/ The method of claim 9, in which delivery takes place prior to the expiry of the time delay in the event of receiving confirmation that the card has been successful in putting the flag into the ratified state.

11/ The method of claim 9, in which a pause of random duration is included in the transaction.

12/ The method of any preceding claim, in which the information interchanged between the machine and the card is enciphered in such a manner as to avoid revealing the moment at which the machine instructs the card to put the flag into the ratified state, or the moment at which the card performs that instruction.

13/ The method of any preceding claim, including, in the machine, counting the number of occasions on which it reads a flag in the non-ratified state.

14/ The method of any preceding claim, including the card counting the number of occasions on which it stores the flag in the non-ratified state between two transactions.

15/ The method of claim 13 or 14, in which means are provided to indicate that a given threshold has been

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exceeded by the count in the card, in particular means for inhibiting subsequent delivery of goods or service.

- 5 16/ The method of any preceding claim, in which the card memory includes information about the kind of goods or service to be delivered, which information is updated before any delivery of said goods or service.

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A B S T R A C T

The card contains value information suitable for being debited by the machine in consideration for delivering goods or service. The machine causes a ratification flag stored in the non-volatile memory of the card to be modified between two states, namely: a ratified state corresponding to the case where the preceding transaction performed with the card, whether with the same machine or with another machine, took place correctly, and a non-ratified state for the case when said preceding transaction was interrupted in the course of being executed. The machine successively: conditionally debits the card if the flag is in the ratified state; causes the card to put the flag in the non-ratified state if a debit took place in the preceding step; then causes the goods or service to be delivered; and if delivery takes place effectively in the preceding step, causes the flag to be put by the card into the ratified state.

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RULE 63 (37 C.F.R. 1.63)
INVENTORS DECLARATION FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

As a below named inventor, I hereby declare that my residence, mailing address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD FOR EXCHANGING DATA BETWEEN AN AUTOMATIC DISPENSER AND A MICROCIRCUIT CARD

the specification of which (check applicable box(es)):

☐ is attached hereto

☐ was filed on

as U.S. Application Serial No.

(Atty Dkt. No. 677-22)

☒ was filed as PCT International application No.

PCT/FR99/02470

on

13 October 1999

and (if applicable to U.S. or PCT application) was amended on

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose to the Patent Office all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed or, if no priority is claimed, before the filing date of this application:

Priority Foreign Application(s):

Application Number

Country

Day/Month/Year Filed

98/12770

FR

13 October 1998

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

Application Number

Date/Month/Year Filed

I hereby claim the benefit under 35 U.S.C. 120/365 of all prior United States and PCT International applications listed above or below:

Prior U.S./PCT Application(s):

Application Serial No.

Day/Month/Year Filed

Status: patented

pending, abandoned

PCT/FR99/02470

13 October 1998

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. And on behalf of the owner(s) hereof, I hereby appoint **NIXON & VANDERHYE P.C., 1100 North Glebe Rd., 8th Floor, Arlington, VA 22204-4714, telephone number (703) 818-4000** (to whom all communications are to be directed), and the following attorneys thereof (of the same address) individually and collectively owner's/owners' attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent: Larry S. Nixon, 25640; Arthur R. Crawford, 25327; James T. Hosmer, 30184; Robert W. Faris, 31352; Richard G. Besha, 22770; Mark E. Nusbaum, 32348; Michael J. Keenan, 32106; Bryan H. Davidson, 30251; Stanley C. Spooner, 27393; Leonard C. Mitchard, 29009; Duane M. Byers, 33363; Jeffrey H. Nelson, 30481; John R. Lastova, 33149; H. Warren Burnam, Jr., 29368; Mary J. Wilson, 32958; J. Scott Davidson, 33488; Alan M. Kagan, 36178; Robert A. Molan, 29834; B. J. Sadoff, 36883; James D. Berquist, 34776; Updeop S. Gill, 37334; Michael J. Shea, 34725; Donald L. Jackson, 41090; Michelle N. Lester, 32937; Frank P. Presta, 19828; Joseph S. Presta, 35329; Joseph A. Rhoads, 37515; Raymond Y. Mah, 41428; Chris Comuntzis, 31097. I also authorize Nixon & Vanderhye to delete any attorney names/numbers no longer with the firm and to act and rely solely on instructions directly communicated from the person, assignee, attorney, firm, or other organization sending instructions to Nixon & Vanderhye on behalf of the owner(s).

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